Computational and Experimental Investigation of Liquid Propellant Rocket Combustion Instability

Completed Technology Project (2012 - 2015)

Project Introduction

Combustion instability has been a problem faced by rocket engine developers since the 1940s. The complicated phenomena has been highly unpredictable, causing engine failures and adding significant risk and development costs to rocket programs. Through the advancement of computer technology the capability has arisen to model combustion instability using high fidelity computer models. Many advances are needed before an accurate prediction tool can be realized. Innovative research is underway at Purdue that integrates experimental results, computational simulations and low-order engineering models to develop such a tool. The objective of the proposed research is to integrate these methods in developing a model to investigate combustion instability in hydrocarbon-fueled rocket engines. The response of oxygen-RP-1 combustion to an imposed oscillatory flowfield under high pressures and temperatures will be measured using advanced imaging techniques and will be simulated using hybrid RANS-LES computations. These results will lead to a combustion response model for use with liquid rocket engines. The new capability to predict combustion instability will be directly applicable to the advanced booster engines on the Space Launch System. This innovative technology applies to other rocket development programs and will advance the Nations space mission capabilities.

Anticipated Benefits

The new capability to predict combustion instability will be directly applicable to the advanced booster engines on the Space Launch System. This innovative technology applies to other rocket development programs and will advance the Nations space mission capabilities.

Project Image Computational and Experimental Investigation of Liquid Propellant Rocket Combustion Instability

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Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Responsible Program:

Space Technology Research Grants

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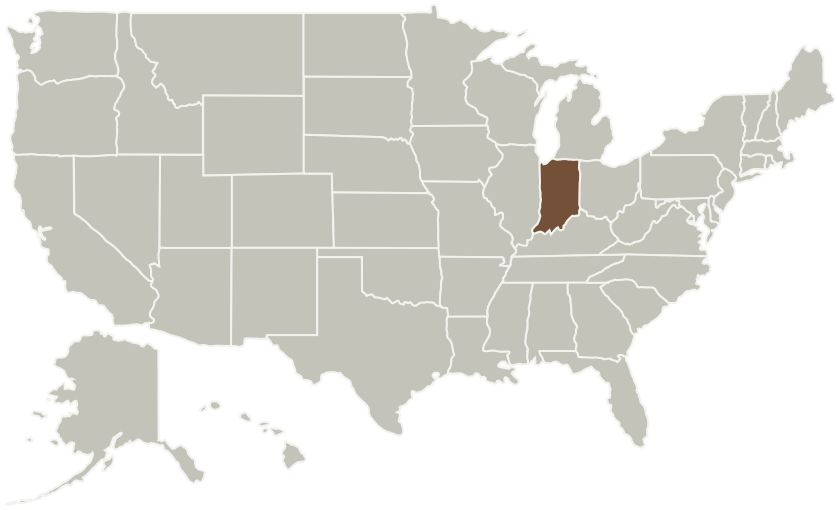
Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Purdue University-Main Campus	Supporting Organization	Academia	West Lafayette, Indiana

Primary U.S. Work Locations
Indiana

Project Management

Program Director:
Claudia M Meyer

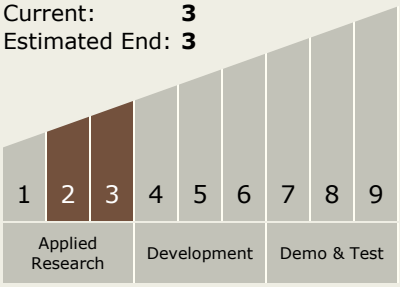
Program Manager:
Hung D Nguyen

Principal Investigator:
William R Anderson

Co-Investigator:
Kevin Shipley

Technology Maturity (TRL)

Start: **2**
Current: **3**
Estimated End: **3**



Technology Areas

Primary:

- TX01 Propulsion Systems
  - TX01.3 Aero Propulsion
    - TX01.3.4 Pressure Gain Combustion

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Images

11536-1363118720701.jpg
Project Image Computational and Experimental Investigation of Liquid Propellant Rocket Combustion Instability
(https://techport.nasa.gov/image/1731)

Project Website:

https://www.nasa.gov/directorates/spacetech/home/index.html